I have used it extensively, and have found that in the ordinary run of cases it is not needed, and in those of the most violent type it does no good. Besides it irritates the stomach, and promotes or aggravates diarrhœa, two very strong objections to its use. But it is of value in a certain class of cases in which there is bronchitis or pneumonia, and where the stomach is not irritable, and when there is no diarrhœa. The cases in which there is diarrhœa of any severity require the use of hydrotherapy, and are rarely controllable by any other means.

When the kidneys are involved, I have found the use of dry cups over the loins, the wet pack, and jaborandi to compose the most successful remedies. The case of W. M., reported in these pages, furnishes a good illustration of the beneficial results that may be achieved by the two latter. The infusion of jaborandi has appeared to me more reliable than the fluid extract, but pilocarpine is, under certain circumstances, preferable to either.

Scarlatina hemorrhagica requires a plan of treatment that will lessen the intense cutaneous hyperæmia, and tend to restore the arrested functions of the skin. Cloths wrung out of water at a temperature of 85° or 90°, aplied to the surface, and changed every hour or two, prove serviceable in this respect, and are both soothing and refreshing to the patient.

These cases soon show signs of exhaustion, and demand a supportive regimen from the very beginning.

In scarlatina fulminans no treatment does any good. The extreme violence of the attack, and the rapidity with which it proves fatal, afford no time for the action of remedies. Such cases are, from their very nature, hopeless.

ARTICLE II.

A CASE OF LODGMENT OF A FOREIGN BODY IN THE CAVITIES OF THE NOSE, ORBIT, AND CRANIUM, WHERE IT REMAINED FIVE MONTHS; REMOVAL BY OPERATION; SUBSEQUENT TREPHINING FOR PUS IN THE BRAIN; DEATH; AUTOPSY. By HENRY D. NOYES, M.D., of New York.

LEWIS EVERETT AVERY, 19 years of age, living in Sullivan County, New York, a farmer in robust health, was wounded in the face by the explosion of a gun while shooting snipe at five o'clock in the morning of September 18, 1881. By the explosion, the lock of the gun was blown off, and also the piece called the breech-pin, by which the barrel is fastened to the stock. Most of the stock remained attached to the barrel. He was knocked senseless, and his brother, who was a little distance behind him, says that he heard something whiz past as the gun exploded. The boy was conveyed to his home in a wagon, a distance of half a mile, and remained unconscious about four days. A physician was called immediately after the receipt of the injury, who dressed the wounds, and said that the right eye was destroyed, and also said—quoting from a letter from the boy's father—"that there was something there which he did not understand."

The patient did not vomit after the injury, and when he came to his senses he did not afterwards lose his mind, nor have any delirium. He remained in bed for four days, and was attended by the physician for about three weeks. He soon afterwards came to New York to get advice, and presented himself at the New York Eye and Ear Infirmary on the 5th of October, 1881. In the notes of the house-surgeon it is said that the eye was in a state of general inflammation, and that there was a large scar extending from the middle of the nose outwards and upwards along the inner third of the eyebrow. There was a fistulous opening near the inner end of the brow, and a probe struck upon a hard body, whose character was not verified, and then passed down towards the nose. The suggestion that the breech-pin of the gun might possibly have lodged there was emphatically dissented from by both the patient and his brother. Neither of them believed that it could be possible, and the brother asserted that he heard the breech-pin whiz past him at the time of the explosion.

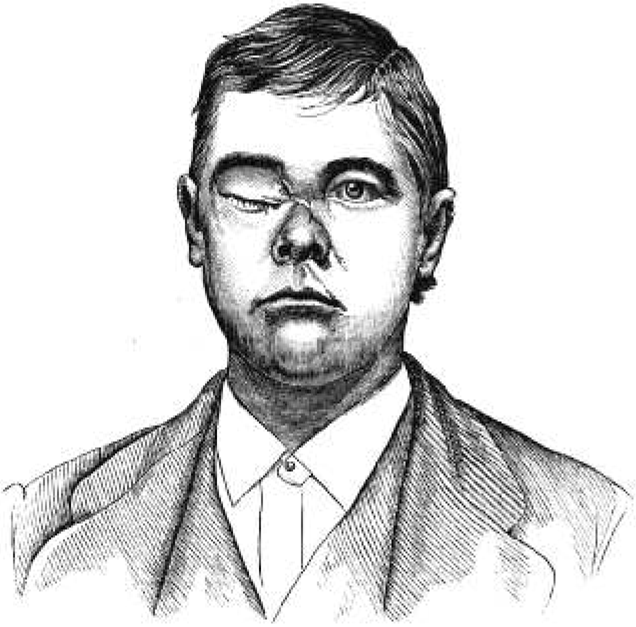
The eye was in a condition of suppuration, and was treated by warm applications. A free escape of pus occurred from the sinus in the brow, from which also two small pieces of wood came away. The eyeball shrank, the swelling of the orbital tissues abated, the discharge both from the fistula and from the nose gradually decreased, and the patient returned home at the end of about three weeks.

Nov. 25. He returned to the Infirmary for inspection, and there had been a notable improvement in the appearance of the parts; healing had occurred very perfectly, his general health was good, his intelligence unimpaired, and he suffered no inconvenience.

Feb. 8, 1882. He came again to the Infirmary with a view to having some attempt made to repair the deformity of his face.

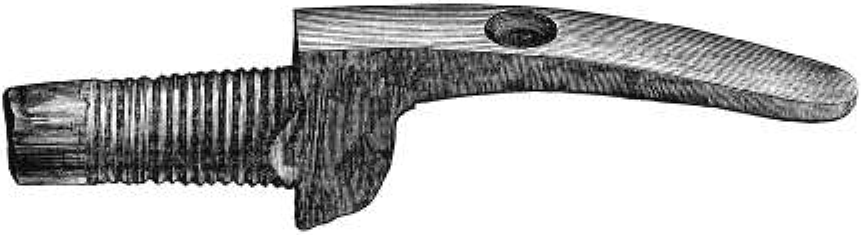
13*th*. He was intrusted to my care for the performance of a plastic operation. Not having seen him before, I examined him carefully and found his condition at that time to be as follows: He was a stoutly-built, unimpressible young man, rather slow of speech, apparently in good health, with a deep scar extending from the middle of the fractured and depressed nose along the inner canthus of the right eye upwards and outwards to about the middle of the brow. The upper lid was closed, the palpebral fissure was below the normal level, a fistulous opening existed (see Fig. 1) at the inner border of the eyebrow, the right eyeball was atrophied and immovably adherent to the tissues at the inner portion of the orbit, and from the nostrils there was an offensive discharge, which suggested the presence of carious bone. The nasal bones were badly sunken, and the tip of the nose turned up, as shown by the engraving. On exploring the nasal cavity, by the aid of a mirror and gaslight, a foreign body was discovered in the middle of the right side, which clicked like iron when touched with a probe. The finger passed through the mouth into the posterior naris, came in contact with this body, and the patient submitted to a pretty vigorous attempt at its extraction, when it was seized in front by a pair of strong polypus forceps, and pressed upon from behind with the forefinger of the other hand carried up behind the soft palate. The mass could not be stirred, and I was soon convinced that it extended into the orbital cavity. Nothing more was done at that time, and the case was reserved for operation on the following Friday, February 17. The intention was to remove the foreign body, and reserve any procedure of a plastic character for a future time. The precise extent and situation of the body was unknown. Its discovery had been a surprise. The patient was etherized. As a preliminary step, the patient being upon the back, the posterior nares were plugged with sponges, a proceeding which was accomplished with considerable difficulty, but it was effectual, inasmuch as no blood whatever escaped into the throat during the operation. An incision was made through the scar in the middle of the nose, and the foreign body searched for at the inner side of the orbit. It presented at that point a squared surface about half an inch across, and when exposed was grasped by a pair of common pliers, which took a firm hold of it, but it was immovable. The dissection was carried further up along the brow, and the foreign body was traced upward, outward, and backward towards the roof of the orbit. It was proved that the foreign body was iron, not only by its appearance, but by touching it with an electro-magnet, and in subsequent steps of the operation the magnet was valuable as a means of distinguishing a bony surface from the foreign body when the parts were concealed by blood. The dissection towards the roof of the orbit was made mostly with scissors, guided by the forefinger of the other hand, and it was found that the mass disappeared through the roof of the orbit at its upper and outer angle at some distance behind the lachrymal fossa. At this time an extensive wound had been made into the cavity of the orbit and nose, and the ethmoid cells had been opened, but the foreign body was singularly hidden from view, below the margin of the orbit. In order to expose its lower part, it was necessary to clip away with bone-forceps the edge of the orbit, and at length its full extent was brought to view.

Fig. 1.



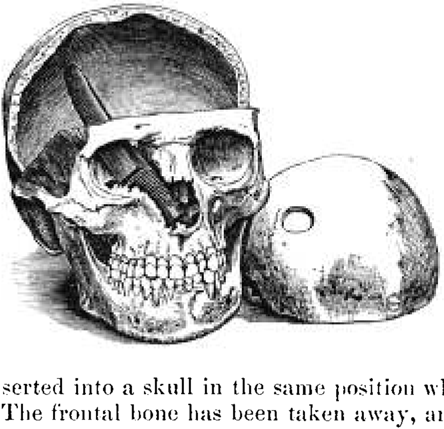
The explanation of the difficulties which were encountered at this stage of the operation is found in the peculiar form of the foreign body, as shown in Fig. 2.

Fig. 2.



The rounded end of the piece of iron, lying in the right nasal fossa, and pressing firmly against its floor, was now seized with the pliers, and gently lifted forwards. It was then caught in a line parallel to its long axis, and with great care very slowly extracted by pulling downwards and to the left across the median lines. It laid in such a position that the shoulder above the cylindrical part rested upon the floor of the orbit. The tapering extremity passed beyond the roof of the orbit to the distance of an inch and a half, namely, to near the place of the screw hole, where it was fastened to the stock of the gun. It proved to be $4\frac{7}{16}$ inches in length, or eleven centimetres; its breadth was about a half inch, or twelve millimetres, and its weight was two ounces, five drachms, and twenty-five grains, or about eighty-four grammes. The cylindrical portion is marked with a thread of a screw, and forms the chamber of the gun, and on one side is a hole, through which the nipple passes. In Fig. 3 the foreign body has been inserted into a skull in the same position which it occupied in the patient. The frontal bone has been taken away, and is placed beside the skull. The round hole in the frontal bone denotes the place where, at a subsequent time, the trephine was applied to reach an abscess in the brain. The shrunken eyeball was next excised, and a free communication established between the apex of the orbit, where the foreign body had been lying, and the conjunctival sac. The wounds through the skin were adjusted, the palpebral fissure, by a little dissection, brought up

Fig. 3.



to its proper level, and the edges united by sutures. No other attempt was made to correct deformity.

When the foreign body was removed, the roof of the orbit was carefully explored with the forefinger, and the hole in it was so small that it just admitted the tip. When the operation was concluded, the finger, passed through the palpebral opening, could easily touch the aperture in the roof of the orbit. A tent was introduced between the lids back to this point. It was believed that by so doing a sufficient facility for drainage would be secured, inasmuch as the track of the body through the nasal cavity procured another outlet. The operation occupied rather more than two hours, and the hemorrhage was not severe.

It may be remarked that the deep situation which the foreign body occupied, not only concealed it from view, but from exploration by the finger, except in the nasal cavity. The patient had suffered no pain, was entirely free from dizziness, was unconscious of any inconvenience, except the discharge from the nostril and from the fistulous opening in the brow; his intellect was clear, his memory was unimpaired, and in every essential respect he considered himself well. The deformity of his face was the exclusive reason for his seeking advice. He was of resolute character and fair intelligence.

The reaction during the night after the operation was moderate. His temperature was 103° F., and pulse 100. The sponges which had been left in the posterior nares caused him serious discomfort, and they were removed. He was put upon tincture of aconite root one drop and a half every half hour, until eight o'clock the next morning, when his pulse was 90 and the temperature $101\frac{3}{5}$° F. The tent was removed from the orbit, allowing some pus to escape. He had severe pain in the head, and iced applications were ordered. In place of the tent a soft rubber drainage tube was introduced. The aconite was continued.

19th. Second day after the operation. Pulse 72; temperature 98° F. Has slept well. Is comfortable.

20th. There is considerable swelling of the parts. The orbital cavity was well syringed out with a two per cent. solution of carbolic acid. There is only a slight discharge from the nose.

22d. At 6 A. M the temperature $99\frac{3}{5}$° F., and pulse 72. At 4 P. M. the temperature $100\frac{1}{2}$° F., and pulse 68. The tongue dry and covered with sordes. The bowels constipated. Ordered a saline laxative and sweet spirits of nitre.

23d. At 8 A. M. the temperature was $101\frac{1}{2}$° F.; pulse 62, and irregular. The patient was drowsy and indisposed to talk. The tongue was covered with a dry brown crust, sordes upon the teeth and roof of the mouth. The patient had no appetite, and complains of pain in the occiput. Rubber bag filled with ice applied to head.

To-day the patient was seen in consultation by Dr. R. F. Weir. It was suggested that pus might be retained in the apex of the orbit, and an exploration of the parts through the palpebral opening gave vent to a small quantity.

The wounds in the skin had been opened on the *third* day, and gave vent to secretion, and to-day, the sixth day, the cavity of the nostril was easily accessible through the operation wound. In order to provide a more free escape of matter, a hard-rubber Eustachian catheter, considerably curved, was passed up along the track which the foreign body had occupied towards the roof of the orbit, and left in position. In the evening the pulse was irregular and the lethargy continued. After some hesitation as to the proper course to be pursued, it was decided to give stimulants, and beginning at 8 P. M., a teaspoonful of whiskey was administered every hour until 11 o'clock. The ice-cap was continued to the head.

24th. The patient has experienced some relief from the measures employed, but his pulse ranges from 68 to 58, and his temperature from 100° F. to 99⅗° F.

25th. Temperature 99⅗° F.; pulse 54. Appetite improving, expresses a desire for fruit. His diet consists of milk, eggs, and beef-tea.

26th. Temperature 99° F.; pulse 52. Continues to take stimulants and milk. The wounds emit a fetid discharge. From the second day after the operation, the cavity of the orbit, the track of the wound, and the nostrils, were washed out with a two per cent. solution of carbolic acid two and three times daily, and great pains were taken to secure perfect cleanliness.

March 1st. Temperature 99° F.; pulse 60. Gave ether and made a free division of the tissues about the inner canthus, and passed a large silver probe along the track of the wound through the orbital plate into the brain and gave exit to some pus having a fetid odor. A curved hard-rubber Eustachian catheter was introduced as a drainage tube and left lying in the nostril and another one passed through the palpebral fissure.

2d. Temperature 99° F.; pulse 54.

3d. Temperature 99° F.; pulse 52. Feeling convinced that suppurative inflammation was taking place in the brain, with the assistance of Dr. John P. Gray, of Utica, Dr. R. F. Weir, Dr. T. T. Sabine, and Dr. E. G. Loring, ether was administered, the orbit entered by an extensive incision through the upper lid just below the brow, the finger introduced into the hole in its roof and the plate of bone broken away with forceps and a rongeur. The dura mater was crossed by a thickened band of tissue, and a feeling of fluctuation was distinctly recognized. The dura mater was freely incised upon the finger as a guide, and a small quantity of very offensive pus escaped. While giving the ether, it was noticed that the patient used the right arm in his struggles much more freely than the left, and this was the first time that any paralysis had been observed. Besides the pus removed by incising the dura mater, some fragments of bone were taken out. A soft-rubber drainage tube was passed through the opening in the roof of the orbit, and the outer end secured to the skin of the cheek by a stitch.

4th. The wound has been syringed out, the tube removed and cleansed and replaced three times a day. The patient complains of pain in the back of the neck, and right shoulder and arm. The paresis of the left forearm and hand remains unchanged. The bowels were moved by stimulating enemata. Poultices are being applied about the orbit. The patient eats ice-cream freely. From the 25th of February to this date the patient's lethargy has disappeared.

5th. Temperature ranges between 99½° F. and 100⅘° F.; pulse from 68 to 105, reaching 96 at midnight. Paresis of the left forearm and hand continues. Dr. E. D. Janeway examined the patient in consultation, and found the following symptoms, namely: paresis of the extensors of the wrist and fingers of the left hand, the grasp of the left hand twenty-five per cent. weaker than that of the right; supination and pronation weakened, but the extensors appeared to be more powerful than the flexors. The muscular power of the left leg was impaired, and during the examination paresis of the left side of the face made its appearance. He thought that the lesion in the orbital convolutions had extended to the medullary matter of the *second* and *third* frontal convolutions, and that the paresis depended upon an œdematous condition of the medullary substance rather than upon a distinct abscess; the left half of the tongue was paralyzed as well as the face. The absence of all convulsive movements upon the paralyzed side was regarded as evidence against meningitis, and Dr. Janeway thought that the cortex was not involved. He regarded it as probable that an abscess existed in the vicinity of the place where the foreign body had been lodged.

At 3 P. M. consultation was held with Dr. H. B. Sands, Dr. T. T. Sabine, and Dr. L. A. Stimson, and it was decided to trephine the skull and search for an abscess. The place decided upon at which to open the skull was in accordance with the views Dr. Janeway expressed concerning the probable pathological condition of the brain. The patient was etherized and the trephine used at a point three inches above the external angular process of the frontal bone, just in advance of the coronal suture; this was in front of the middle meningeal artery, and intentionally anterior to the motor tract. The dura mater was not injured by the trephine. It pressed upward into the hole, but *no pulsation* could be observed. It felt firm and rather tense. A crucial incision was made through it, and the surface of the brain appeared slightly congested. An aspirating needle was carried downwards and forwards towards the orbital opening to the distance of one and three-quarter inches, at which depth a dark brown fluid appeared in the syringe followed by healthy pus, and this was succeeded again by a dark brown fluid. It was estimated that five drachms of purulent matter were removed. With one finger in the orbital opening, a probe was passed from above downwards to meet it, and a drainage tube was carried through the trephine hole down through the orbit, passing through the substance of the brain. A four per cent. solution of boracic acid was syringed through the tube three times a day, and its position changed.

6th. Temperature 100$\frac{1}{5}$° F. to 101° F.; pulse 90 to 78.

7th. Second day after the trephining. A probe was passed through the brain substance about an inch and a half, downward and forward, and gave exit to half an ounce of yellow pus which welled up. Poultices were continued to the side of the head. Five grains of the sulphate of quinine with half an ounce of whiskey were given every two hours until four doses were taken. Temperature 100° F.; pulse 98 to 103. The patient suffers great pain in his right arm and shoulder. Paresis of the left forearm and hand remains unchanged. The paralysis of the tongue and face seems to have been partially relieved.

8th. The wound was probed from above through the trephine hole, and about one drachm of pus removed. The quinine and whiskey were continued, viz., 20 grains of quinine and about two ounces of whiskey daily. The patient complains of difficulty of breathing upon the right side, and passed a very restless night. Wishes to be turned over frequently. There is little discharge from the wound, and the drainage-tube appears to be choked. It was removed and a larger one substituted. Temperature 101$\frac{1}{5}$° F.; pulse 100.

9th. The patient passed a comfortable night, and at six o'clock in the morning asked for beefsteak and a cup of coffee, which were given to him. At 12 M. the temperature was 104° F.; pulse 101. When the wound was dressed the probe was introduced and considerable pus was liberated. He still complains of difficulty of breathing in the right side of the chest and pain in the right arm. Linseed poultices with mustard were applied to the back and chest. Careful examination does not discover any lesion of the lungs. A dose of salts was given. Ordered quinine in 10-grain doses. At midnight the pulse was 104, and temperature 101$\frac{4}{5}$°.

10th. Temperature ranges from 100$\frac{3}{5}$° F. to 103° F.; pulse from 101 to 90. The trephine hole is occupied by a mass of granulations and blood which was torn off, and some drops of dark-coloured pus escaped. All the dyspnœa and pain in the shoulder have disappeared, and examination of the chest reveals no lesion of either lungs or pleura.

11th. Temperature 101$\frac{1}{5}$° F. to 100° F.; pulse 90 to 98, reaching the highest point about noon.

12th. The patient examined in consultation by Dr. Janeway. The temperature 100$\frac{1}{5}$° F.; pulse 98. There is partial anæsthesia of the left hand, especially of the index finger. The sensation of the left leg is about the same as of the right. The grip of the left hand is about 25 per cent. less than that of the right. By striking over the tendons of the wrist and leg no increased reflex is noticed. Ordered 10 grains of quinine every six hours, with half an ounce of whiskey every two or three hours during the day.

13th. Pulse quick, feeble, and irregular. Considerable pus discharges from the wounds, and syringing into the orbital cavity causes the fluid to pass up through the trephine hole, indicating that free communication exists between the two openings, and the patient has been lying most of the time upon his left side and with the head thrown back. This position has made the exit of pus from the trephine hole easier than from the opening in the roof of the orbit. Temperature 100$\frac{1}{5}$° F.; pulse 94 to 120.

14th. Temperature 100$\frac{1}{5}$° F. to 99$\frac{1}{5}$° F.; pulse from 114 to 92. He continues to take 40 grains of quinine daily. Very early in the case the optic nerve of the left eye was examined and found to be œdematous, presenting the appearance of papillitis or choked disk; to-day it was again examined, and the condition found to be more pronounced, and hyperæmia more marked. The patient is perfectly intelligent, is in entire possession of his intellectual faculties, does not suffer great discomfort, and behaves well. The granulating surface in the trephine hole bleeds freely when touched.

15th. Temperature 99$\frac{4}{5}$° F.; pulse 92 to 112, reaching its highest point about noon.

16th. Temperature 99° F.; pulse 85. The patient has some frontal headache upon the right side. The quinine was reduced to 20 grains daily. He eats well. His diet for the preceding two weeks has been largely of ice-cream, of which he has taken from two to three quarts daily. Hearing and vision good. Paresis about the same.

17th. Temperature 99° F.; pulse 78 to 85, and slightly intermittent. Pus escapes from the orbital opening; water passes through both openings when the cavity is syringed. The left arm has become smaller and softer than the right. The patient complains of headache over the right frontal region, extending to the occiput. Ice bag applied.

18th. Temperature 99° F.; pulse 85 to 98. Ice-bag to the head continued.

19th. Temperature 99° F.; pulse 75 to 90. It was found upon examining the orbital opening that pus was retained in its vicinity, and by using a long probe bent to a sharp curve, it was discharged.

The paralysis of the left side of the face and tongue has for several days been very marked; but at no time has it affected the orbicularis muscle. The patient takes 20 grains of quinine daily.

20*th*. Shortly after taking a dose of whiskey the patient vomited. It was found that pus existed in the vicinity of the trephine hole, in the region posterior to it. After its removal the patient was more comfortable, and his pulse stronger and more regular. He now begins to be indifferent to the state of his bladder, and is apt to wet the bed. Temperature 99° F.; pulse 90 to 76, and irregular.

Since the granulations at the trephine hole have become redundant and inclined to bleed, they have been cut down with Jarvis's snare, armed with piano wire No. 7, and the subjacent brain tissue has been removed in the same way, thereby affording easier escape for the pus.

21*st*. Temperature 99° F. to $99\frac{4}{5}$° F.; pulse 78 to 88. About one drachm of very offensive pus discharges from the openings at each dressing. The granulations are removed twice a day. Quinine and whiskey are continued. Syringing through the brain substance is no longer performed, and the probe is not used for evacuating the pus.

From March 22d to March 25th the temperature ranged from $99\frac{2}{5}$° F. to 100° F.; and the pulse from 88 to 103. On the night of the 25th the patient vomited.

26*th*. The patient was restless during the early part of the night. He received three enemata during the day, but without effect upon the bowels.

Fearing that pus remained concealed and was unable to escape, I passed my finger through the orbital opening and found a pocket of pus. The finger went backwards to the distance of three inches, and found the brain substance badly broken down.

Dr. Janeway saw the patient again, but found no evidence of pyæmia or meningeal complication. The temperature of the brain taken by introducing the thermometer through the trephine hole was 101° F., in the axilla $100\frac{1}{5}$° F. Pulse intermittent at times; 96 to 110.

27*th*. The patient had a restless night, and vomited three times within an hour. At the morning dressing, the wound of the orbit was full of disorganized tissue, which had to be removed by the snare, and a large slough soon followed, together with considerable pus. At the afternoon dressing I removed an additional quantity of sloughy material, and brought away a large necrotic mass, similar to that removed in the morning. The two together appeared to constitute the cyst which had inclosed the extremity of the foreign body in the brain. The slough was gray and fibrous upon one side, presenting a distinctly membranous character, and upon the other side was covered with broken-down white brain substance, with numerous points of capillary hemorrhage. The soft parts around the orbital opening have contracted together so as to interfere with the escape of fluid and with the dressing, and, therefore, the opening was enlarged by an incision upon its temporal extremity. The bowels have been constipated for some days, and no relief has been afforded by enemata. Ordered one drop of croton oil. Pulse very intermittent.

28*th*. Has had a bad night, and has nausea and vomiting. Free hemorrhage has taken place from the orbit, the cavity is occupied by a clot and granulations which protrude about one inch. When this was removed hemorrhage continued to occur, and was with difficulty arrested.

The patient is evidently much worse. Temperature 103$\frac{4}{5}$° F.; pulse 108. The temperature continued to rise, and at 10 A. M. was 104$\frac{4}{5}$°, and the pulse jumped to 160. During the day the patient gradually sank, and died at about 1 o'clock on the morning of March 29th, which was the thirty-ninth day after the removal of the foreign body.

He continued perfectly intelligent up to within *two* hours of his death, although indisposed to talk.

Hypodermic injections of whiskey were giving during the day, and beef-tea per rectum. There were no convulsions, nor additional paralysis, nor delirium. The patient could always be aroused, and did not suffer severe pain.

From the 6th of March to his death he was vigilantly cared for by Mrs. Dr. Pratt, of Salt Lake City, who performed much of the dressing and aided the House Surgeon, Dr. Charles Orr. He also had the constant services of two nurses.

The *autopsy* was made twelve hours after death, by Dr. W. H. Welch, assisted by Drs. J. L. Minor and Charles Orr. The following is Dr. Welch's report.

Autopsy.—By request only the head was examined.

External Appearances. The upper part of the nose is sunken in in consequence of depression and partial loss of the nasal bones. Immediately below the right eyebrow there is a gaping hole, 3 ctm. in transverse, 2 ctm. in vertical diameter. This hole extends horizontally along the upper margin of the upper eyelid, which is thereby somewhat depressed. This hole extends through the integument, subjacent tissues, and orbital plate of the frontal bone into the cranial cavity; the right eyeball is absent; there is a round hole $\frac{3}{4}$ ctm. in diameter, a little to the right of the median line of the nose, and on a level with the lower margin of the orbit. A probe can be passed through this hole into the nasal cavity; from this hole can be traced a line of cicatrix upwards to the gaping wound first described, and obliquely downwards for a distance of 3 ctm. to the left side of the nose. Another cicatricial line extends from the small hole for 3$\frac{1}{4}$ ctm. along the right side of the nose to the nostril.

Near the roots of the hair on the right side there is an opening 2$\frac{1}{4}$ ctm. in diameter through the integuments and frontal bone into the cranial cavity. This opening is situated 5 ctm. from the median line and 7 ctm. from the orbital margin of the frontal bone; around the margin of this opening, posteriorly and inferiorly, the bone is laid bare for a distance of 2 ctm. A λ-shaped cicatrix 5 ctm. long extends from the opening downwards towards the ear.

Brain and Membranes. Upon removal of the calvaria, openings are found in the dura mater which correspond in situation to those existing in the cranial bones. One is situated opposite the opening in the vertical plate of the frontal bone, the other corresponds to the opening in the horizontal plate of the same bone; around the margins of these openings, as well as elsewhere, the external surface of the dura mater appears normal. The dura mater presents no abnormal separation from what remains of the bones forming the floor of the right anterior fossa of the skull, being as usual here quite adherent. The superior longitudinal sinus contains a loose, decolorized post-mortem clot. The other sinuses contain reddish clots and fluid blood, but no thrombi.

Upon cutting through the dura mater on a line with the sawn surface of the cranium, this membrane is found to be without abnormal adhesion, save around openings into the brain, which correspond in situation to the openings previously described in the dura mater and the bone; around these openings, which exist one on the convexity and the other on the orbital surface of the right frontal lobe, the dura mater is firmly adherent for a distance of $\frac{1}{2}$ to $1\frac{1}{2}$ ctm. to the subjacent pia-arachnoid membrane. These adhesions are such that fluids injected into the cavity formed in the frontal lobe (as described below), or escaping from this cavity, would not make their way into the surrounding sub-dural space. For a distance of 3 or 4 ctm. around these openings the inner surface of the dura mater presents the appearances of a hemorrhagic pachymeningitis. It is here coated with a thin yellowish-brown delicate membrane, which can be stripped up with the forceps, and which in places is adherent to the pia-arachnoid membrane. A short distance in front of the opening on the convexity of the frontal lobe a small, loose red coagulum of blood rests on the pia mater. Elsewhere the inner surface of the dura mater appears normal.

For a distance of about 2 ctm. around the openings into the frontal lobe the pia mater is of a yellowish color, and contains a few small ecchymoses. Elsewhere over the convexity of the hemispheres the pia mater presents a normal appearance. The pia mater covering the base of the brain, however, is acutely inflamed. Here there is a sero-purulent, yellowish-green exudation into the meshes of the pia mater, most abundant over the medulla oblongata, pons, inter-peduncular space, and inner parts of the fissures of Sylvius. This exudation is as much on one side of the brain as on the other, and does not extend to the convexity, where there is rather less than the normal quantity of fluid in the pial meshes.

The convolutions of the left cerebral hemisphere appear somewhat flattened as if there were increased intra-cerebral pressure. The lateral ventricles on both sides contain an increased amount of fluid rendered turbid by admixture of fibrin and pus, which also infiltrate the choroid plexuses. In each ventricle the fluid amounts to about 50 cubic ctm.

The right frontal lobe is somewhat sunken in. On the convex lateral surface of this lobe is a nearly circular hole about 5 ctm. in diameter, which opens into a cavity occupying the interior of this lobe. This hole involves the second and third frontal convolutions, which are thereby destroyed to a corresponding extent. The upper margin of this opening is 3 ctm. distant from the superior longitudinal fissure, its anterior margin is $3\frac{1}{2}$ ctm. distant from the anterior margin of the frontal lobe, its posterior margin is $1\frac{1}{2}$ ctm. from the anterior central convolution; the edges of this opening are thin and of a greenish colour, with here and there a few ecchymoses.

The orbital surface of the right frontal lobe is almost wholly destroyed. The gyrus rectus with the olfactory tract and bulb are, however, preserved. This opening into the orbital surface measures about 5 ctm. in diameter, both antero-posteriorly and transversely; the edges of this opening are likewise thin, discoloured, and beset with small hemorrhages. The distance between the lateral margin of the opening in the orbital surface and the inferior margin of that in the convexity of the frontal lobe measures 4 ctm. over the surface of the brain.

The interior of the right frontal lobe is destroyed and occupied by a cavity with soft, greenish, sloughy walls composed of the surrounding brain substance; the walls of this cavity measure from 2 to 8 or 10 mm. in thickness; the innermost part corresponds to the convexity and to the orbital surface of the frontal lobe. This cavity extends backward so as to have undermined somewhat the anterior central convolution. The cavity communicates with the anterior part of the right lateral ventricle. The anterior part of the nucleus caudatus and the adjacent portion of the internal capsule upon this side are destroyed. The white matter of the parietal and temporo-sphenoidal lobes adjacent to the cavity is soft and white in colour. The change here resembles the so-called hydrocephalic softening observed around the ventricles in many cases of tuberculous meningitis, and usually attributed to post-mortem changes. The substance of the left cerebral hemisphere is moist.

After removal of the brain and membranes the opening in the orbital plate of the frontal bone is found to measure 3½ ctm. in antero-posterior, and 3 ctm. in transverse diameter. This opening extends backwards so as to involve the lesser wing of the sphenoid cavity.

The left optic nerve and the posterior segment of the left eye were removed and examined. The dural sheath of the optic nerve is markedly distended by an accumulation of clear serous fluid in the sub-dural space; the optic papilla is decidedly swollen, and presents ill defined contours and a hazy appearance. The central vein and its branches are large and distinct.

The brain, after removal, was placed in Wickersheimer's fluid, where it remained for ten days. It was then transferred to alcohol, in which it acquired a firm consistence, and still preserved nearly its normal colour; after hardening, two frontal sections were made through the hemispheres, one through the anterior central, and the other just behind the posterior central convolutions. The cortex and the immediately subjacent white matter of these convolutions appeared normal. The deeper white matter, however, namely, the foot of the corona radiata, where this latter passes into the anterior part of the internal capsule, is softened upon the right side, and contains several small hemorrhages. The anterior third of the right internal capsule, and a part of the nucleus caudatus is destroyed as already described. The motor tract affected, therefore, includes the anterior part of the internal capsule and the adjacent coronal expansion of its fibres into the centrum ovale. The anterior of the left hemisphere presents no lesions. Upon the hardened brain the sinking in and shrinkage of the right frontal lobe is more marked than it was at the autopsy.

Remarks.—In reviewing the case certain questions arise. *First*, whether the foreign body ought to have been removed? In general and in the abstract this question would require a careful adjustment of many circumstances—and a large material for study. The table of cases compiled by Dr. Wharton, in the *Philadelphia Medical Times*, July 19, 1879, is valuable as a list of references, but unfortunately offers few details. To this may be added the citations under the head of brain, foreign bodies in, and brain, wounds or injuries of, contained in the *Index to the Catalogue of the Library of the Surgeon General's Office*, vol. ii. p. 351 and p. 396. See *Deutsche Chirurgie*, Billroth and Lencke, Lieferung, 30; *Kopfverletzungen*, by Bergman, p. 76 *et seq.* See also the first vol. of *Surgical History of the War of the Rebellion*, from which an analysis of recoveries after lodgment of foreign bodies in the brain, has been made by Dr. John A. Lidell, in the *American Journal of the Medical Sciences*, April, 1881, p. 335, and article on Compression of the Brain, by Dr. S. W. Gross, *Am. Journal Med. Sciences*, July, 1873, p. 40.

With this material certain discriminations must be made as to the location, fixity, duration of residence of a foreign body, and whether it is exciting any irritative symptoms. The last circumstance is of great moment. In the above case no symptoms were present, and this may be attributed to the vigorous health and quiet temperament of the subject, to the absolute immobility of the piece of iron, and to the fact that the lesion was in the frontal lobe, which we know to be more tolerant of injuries than any part of the brain. It may be argued, and with reason, that with the missile undisturbed the patient might have lived for months or years longer. This case will deserve to be quoted in favour of expectant treatment. But it will be offset by a very large number of a contrary kind—when the field of research is fully explored. I think that in this argument the several points to which I have referred will all claim careful consideration. Such a discussion presupposes that the penetration of the brain by the foreign body should be known without any explorative operation. In the case of Avery, the invasion of the brain was not only unknown, but could not have been known without performing the explorative operation. This deep wound would doubtless have occasioned intra-cranial inflammation, and I do not feel any doubt as to the necessity of removal of the foreign body under these circumstances. In corroboration of this view it may be said that the orbital plate was found to have been fractured into the sphenoidal fissure and through that opening a very direct communication was opened to the brain from the explorative wound. The above remarks apply only to cases in which a foreign body has been lodged for a considerable period of time. There would seem to be no doubt of the necessity of extracting foreign bodies which are easily accessible, when they have only recently penetrated the skull.

Second. The fact that the wound was in the orbit causes special peculiarities. In Wharton's list of cases he says that in 18 the missile passed into the brain through the orbit, and that all but one of them were fatal. Berlin, in Graefe and Saemisch, *Handbuch der Ophthalmologie*, Bd. vi. th. iv. s. 599, says that of 52 cases of fracture of the roof of the orbit by penetration of foreign bodies, 41 died, *i. e.*, 80 per cent. He adduces, *l. c.*, page 638, four cases in which foreign bodies had remained for periods varying from forty days (*Demours*, 1818) to seventeen years (*Pagenstecher*, 1864), and had been extracted; both the above died, and the two others (reported by *Percy* and *Günther*) recovered. It is probable that research would discover more cases of this kind of injury, and afford us more data for deductions. Two circumstances seem to have importance in the great mortality of these cases. First, the soft tissues of the orbit choke the aperture in the cranium and prevent easy escapé of discharges; second, the recumbent posture is unfavourable for drainage through this locality, because the injury is at the base of the brain. These two disadvantages were strongly appreciated during the treament of Avery's case after the cerebral abscess had been opened. It was found that the posture which he constantly assumed, namely, on the left or paralyzed side, only imperfectly assisted the outflow of fluid; and, in fact, the trephine hole seemed a more ready outlet than that in the orbital roof. The great obstacle in the orbit was the continuous growth of new tissue, which encroached upon the external and on the bony openings. It would have been better if all the contents of the orbit, in addition to the eyeball, had been removed, the skin of the lids being left. A clean cavity would have made the dressing much easier. In view of the extreme danger which belongs to cases of wounds through the roof of the orbit, I think the suggestion deserves consideration whether a patient's chances might not be improved by excising all the contents of the orbit (*exenteratio orbitæ*), as soon as any tokens of cerebral or meningeal trouble appear. I know that the early symptoms are of uncertain value, and the proceeding might seem uncalled for if not dangerous. But in Avery's case it would have been better to have taken this step on the sixth day after the foreign body was removed. Better drainage would have been secured than by any of the devices which were assiduously employed for this object. Another obstacle, as it proved in Avery's case, was the cyst which had formed like a thimble around the end of the iron in the brain. This did not come away until the thirty-eighth day after removal. Inflammation began outside of it in the brain substance very early. The fluid products of inflammation were pent up outside of it, and could not sufficiently escape through the orbital hole. The only relief would have been a free incision into the dura mater and enlargement of the aperture in the roof by a small pliers or a rongeur. Another proposition intended to meet this difficulty has been made by Berlin (see Graefe and Saemisch), and was also suggested in consultation by Dr. Weir, namely, to chisel away the edge of the orbit for a breadth and depth sufficient to give ample access to the brain. This proposal arose on the sixteenth day, when the existence of a cerebral abscess was not doubted. It would have opened a direct approach to the abscess, and given an outlet not liable to be choked by growth of new tissue. Bergman, quoting Berlin, in *Deutsche Chirurgie*, Billroth and Luecke, page 249, says that the abscess in 18 fatal cases was superficial and close to the place where the bone had been fractured. Of the 18 cases, 15 had abscess of the brain, and only two had meningitis. The near vicinity of the abscess is a point to be remembered. In Avery's case the very free opening of the orbit on the sixteenth day in addition to the trephining, afforded what seemed an abundant means of escape for pus. This was furthermore promoted by using a drainage tube passed through the two openings. But the pulpy nature of the softened brain tissue clogged the holes of the tube, and they were left in position only three days. It is not pretended that the most perfect provision for outflow of fluid will prevent an abscess from extending farther into the brain, and thus becoming fatal. But we certainly have to strive to remove all obstacles which tend to favour its extension. In the famous Harlow-Bigelow tamping-iron case, Dr. Harlow, in a private letter to me, says that is was due in great measure to the free outlets through the skull below and above that the man Gage owed his life.

Third. The final cause of death with my patient was inflammation along the base of the brain. It is probable that the pain on the right side of the chest, which appeared on the eighteenth day, was due to irritation of the pneumogastric. The abscess did not greatly derange his functions, except by the paralysis of the opposite side. His intellect was good, digestion and assimilation good. Certainly the quinine and stimulants had no injurious effects, but quite the contrary. On many occasions it was noted that the removal of pus would be followed speedily by reduction of temperature and by greater steadiness of the pulse. The close adhesion of the dura mater around the orbital opening and the trephine hole completely shut off the arachnoid cavity from the track of the suppuration, and no meningitis spread from these situations, neither could fluids used in syringing get beyond the parts intended to be irrigated. Trial was made of two per cent. solution of carbolic acid, but this excited so much headache that it was abandoned for a four p. c. solution of boracic acid.

For other sources of information in bibliography besides those mentioned in the text see :—

Mackenzie on the Eye, Am. Ed., 1855, pp. 49 to 72.
Chelius, System of Surgery, edited by South, vol. i. p. 436, 1847.
Demarquay, Tumeurs de l'Orbite, p. 240, 1860.
Verletzungen des Auges, Zander und Geissler, p. 224, p. 243, 1864.
Verletzungen des Auges, Arlt, 1875.
Pagenstecher in Monatsblätter für Augenheilkunde, Zehender, 1864, p. 166.
Ferrier on Localization of Cerebral Disease, p. 25.
Albert, Lehrbuch der Chirurgie, p. 104, 1881.

New York, 233 Madison Avenue.

Article III.

Notes of a Case of Lodgment of a Fragment of Iron in the Substance of the Brain; Death in Four Months; Autopsy. By Geo. Burr, M.D., of Binghamton, N. Y.

On the 8th day of October, 1881, Leonard S. S——, a young man of about 20 years of age, residing at North Fenton, in company with another young man of about the same age, went out into the fields and woods for the purpose of shooting squirrels. They were armed with shot